

# Emerging Perspectives on Distinctions Between Romantic Love and Sexual Desire

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**ABSTRACT**—*Although sexual desire and romantic love are often experienced in concert, they are fundamentally distinct subjective experiences with distinct neurobiological substrates. The basis for these distinctions is the evolutionary origin of each type of experience. The processes underlying sexual desire evolved in the context of sexual mating, whereas the processes underlying romantic love—or pair bonding—originally evolved in the context of infant-caregiver attachment. Consequently, not only can humans experience these feelings separately, but an individual’s sexual predisposition for the same sex, the other sex, or both sexes may not circumscribe his or her capacity to fall in love with partners of either gender. Also, the role of oxytocin in both love and desire may contribute to the widely observed phenomenon that women report experiencing greater interconnections between love and desire than do men. Because most research on the neurobiological substrates of sexual desire and affectional bonding has been conducted with animals, a key priority for future research is systematic investigation of the coordinated biological, behavioral, cognitive, and emotional processes that shape experiences of love and desire in humans.*

**KEYWORDS**—*attachment; sexual desire; gender; sexual orientation; evolutionary theory*

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It is a truism that romantic love and sexual desire are not the same thing, but one might be hard pressed to cite empirical evidence to this effect. In recent years, however, researchers in fields ranging from psychology to animal behavior to neurobiology have devoted increasing attention to the experiences, physiological underpinnings, and potential evolutionary origins that distinguish love and desire. The results of these investigations suggest that romantic love and sexual desire are governed by functionally independent social-behavioral systems that evolved for different reasons and that involve

different neurochemical substrates. Furthermore, there are gender differences in the interrelationship between love and desire that may have both biological and cultural origins. This emerging body of theory and research has the potential to profoundly reshape the way we conceptualize human sexuality, gender, sexual orientation, and social bonding.

## INDEPENDENCE BETWEEN LOVE AND DESIRE

*Sexual desire* typically denotes a need or drive to seek out sexual objects or to engage in sexual activities, whereas *romantic love* typically denotes the powerful feelings of emotional infatuation and attachment between intimate partners. Furthermore, most researchers acknowledge a distinction between the earlier “passionate” stage of love, sometimes called “limerence” (Tennov, 1979), and the later-developing “companionate” stage of love, called pair bonding or attachment (Fisher, 1998; Hatfield, 1987). Although it may be easy to imagine sexual desire without romantic love, the notion of “pure,” “platonic,” or “nonsexual” romantic love is somewhat more controversial. Yet empirical evidence indicates that sexual desire is not a prerequisite for romantic love, even in its earliest, passionate stages. Many men and women report having experienced romantic passion in the absence of sexual desire (Tennov, 1979), and even prepubertal children, who have not undergone the hormonal changes responsible for adult levels of sexual motivation, report intense romantic infatuations (Hatfield, Schmitz, Cornelius, & Rapson, 1988).

Furthermore, extensive cross-cultural and historical research shows that individuals often develop feelings of romantic love for partners of the “wrong” gender (i.e., heterosexuals fall in love with same-gender partners and lesbian and gay individuals fall in love with other-gender partners, as reviewed in Diamond, 2003). Although some modern observers have argued that such relationships must involve hidden or suppressed sexual desires, the straightforward written reports of the participants themselves are not consistent with such a blanket characterization. Rather, it seems that individuals are capable of developing intense, enduring, preoccupying affections for one another regardless of either partner’s sexual attractiveness or arousal.

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## MEASURING THE EXPERIENCE AND SUBSTRATES OF LOVE AND DESIRE

Of course, one's interpretation of such data depends on one's confidence in the methods used to assess and contrast love and desire. Whereas sexual arousal can be reliably and validly assessed by monitoring blood flow to the genitals, no definitive test of "true love" exists. Psychologists have, however, identified a constellation of cognitions and behaviors that reliably characterize (and differentiate between) romantic love and passion across different cultures. As summarized by Tennov (1979), passionate love is a temporary state of heightened interest in and preoccupation with a specific individual, characterized by intense desires for proximity and physical contact, resistance to separation, and feelings of excitement and euphoria when receiving the partner's attention. As passionate love transforms into companionate love, desire for proximity and resistance to separation become less urgent, and feelings of security, care, and comfort predominate.

Some of the most provocative and promising research on love and desire focuses on the neurobiological substrates of these distinctive behaviors and cognitions. Although little direct research in this area has been conducted with humans, converging lines of evidence (reviewed by Fisher, 1998) suggest that the marked experiential differences between love and desire may be partially attributable to their distinct neurochemical signatures. Sexual desire, for example, is directly mediated by gonadal estrogens and androgens (see Diamond, 2003; Fisher, 1998), yet these hormones do not mediate the formation of affectional bonds. Rather, animal research indicates that the distinctive feelings and behaviors associated with attachment formation are mediated by the fundamental "reward" circuitry of the mammalian brain, involving the coordinated action of endogenous opioids, catecholamines,<sup>1</sup> and neuropeptides such as oxytocin, which is best known for its role in childbirth and nursing. These neurochemicals regulate a range of emotional, cognitive, behavioral, and biological processes that facilitate social bonding by fostering conditioned associations between specific social partners and intrinsic feelings of reward (reviewed in Carter, 1998).

At the current time, it is not known whether such processes mediate the formation and maintenance of pair bonds between humans, as they have been shown to do in other pair-bonding mammalian species, such as the prairie vole (Carter, 1998). For example, we are only beginning to understand the range of emotional and physical phenomena (other than labor and nursing) that trigger oxytocin release in humans, and whether oxytocin release has consistent effects on subjective experience. Preliminary studies have found fascinating individual differences in the amount of oxytocin released in response to sexual activity, positive emotion, and massage (Carmichael, Warburton, Dixen, & Davidson, 1994; Turner, Altemus, Enos, Cooper, & McGuinness, 1999), and this is a key direction for future research.

<sup>1</sup>The release of catecholamines (most notably, dopamine, epinephrine, and norepinephrine) is associated with a variety of physiological responses that prepare the body to "fight or flee" a stressor (e.g., increased heart rate, blood pressure, and blood glucose levels). In contrast, endogenous opioids are known for their role in diminishing endocrine, cardiovascular, and behavioral stress responses, and are particularly well known for blunting the experience of pain. For this reason, they are often called "the body's own pain killers." These neuropeptides also play a role in the subjective experience of pleasure and reward, and facilitate learning and conditioning.

Another promising avenue for investigation involves the use of functional magnetic resonance imaging (fMRI) to identify brain regions that are activated during experiences of desire versus infatuation versus attachment. In one preliminary study (Bartels & Zeki, 2000), the brains of individuals who reported being "truly, deeply, and madly in love" were examined under two conditions: while viewing pictures of their beloved and while viewing pictures of other-sex friends. Compared with viewing friends, viewing pictures of loved ones was associated with heightened activation in the middle insula and the anterior cingulate cortex, areas that have been associated in prior research with positive emotion, attention to one's own emotional states, attention to the emotional states of social partners, and even opioid-induced euphoria. Viewing pictures of loved ones was also associated with deactivation in the posterior cingulate gyrus, the amygdala, and the right prefrontal, parietal, and middle temporal cortices, areas that have been associated with sadness, fear, aggression, and depression. Notably, the brain regions that showed distinctive patterns of activity when viewing romantic partners did not overlap with regions typically activated during sexual arousal.

Clearly, much work remains to be done to develop a comprehensive "map" of normative brain activity during both short-term states and longer-term stages of desire, infatuation, and attachment; to examine changes in brain activity as individuals move between these states and stages within specific relationships; and to explore whether inter-individual differences in personality and relationship quality moderate such patterns. Perhaps most important, however, we require a greater understanding of the functional implications of different coordinated patterns of activation and deactivation.

## THE EVOLUTIONARY ORIGINS OF LOVE AND DESIRE

Given the accumulating evidence that love and desire are, in fact, functionally independent phenomena with distinct neurobiological substrates, a natural question is, *why*? After all, most individuals end up falling in love with partners to whom they are sexually drawn, and this seems to make good evolutionary sense given that pair bonding with one's sexual partner is a good way to ensure that the resulting offspring have two dedicated parents instead of just one. This view assumes, however, that the basic biobehavioral mechanisms underlying affectional bonding evolved for the purpose of reproductive mating, and this may not be the case. Although these processes would clearly have conferred reproductive benefits on early humans, some researchers have argued that they originally evolved for an altogether different purpose: infant-caregiver attachment.

Bowlby (1982) conceptualized attachment as an evolved behavioral system designed to keep infants in close proximity to caregivers (thereby maximizing infants' chances for survival). Attachment establishes an intense affectional bond between infant and caregiver, such that separation elicits feelings of distress and proximity elicits feelings of comfort and security. Other evolutionary theorists have argued that this system was eventually co-opted for the purpose of keeping reproductive partners together to rear offspring (Hazan & Zeifman, 1999). In other words, adult pair bonding may be an *exaptation*—a system that originally evolved for one reason, but comes to serve another. The fundamental correspondence between infant-caregiver attachment and adult pair bonding is supported by extensive research documenting that these phenomena share the same core emotional and behavioral dynamics: heightened desire for proximity,

resistance to separation, and utilization of the partner as a preferred target for comfort and security (Hazan & Zeifman, 1999). Even more powerful evidence is provided by the voluminous animal research documenting that these two types of affectional bonding are mediated by the same opioid- and oxytocin-based neural circuitry (Carter, 1998).

This view helps to explain the independence between love and desire, because sexual desire is obviously irrelevant to the process of infant-caregiver bonding. Yet even if one grants that affectional bonding and sexual mating are fundamentally distinct processes that evolved for distinct purposes, the question still remains: Why do the majority of human adults fall in love only with partners to whom they are sexually attracted? One reason is obviously cultural: Most human societies have strong and well-established norms regarding what types of feelings and behaviors are appropriate for different types of adult relationships, and they actively channel adults into the “right” types of relationships through a variety of social practices. Additionally, however, both human and animal data suggest that attachments are most likely to form between individuals that have extensive proximity to and contact with one another over a prolonged period of time (Hazan & Zeifman, 1999). Sexual desire provides a powerful motive for such extended contact, increasing the likelihood that the average adult becomes attached to sexual partners rather than platonic friends.

#### IMPLICATIONS REGARDING GENDER AND SEXUAL ORIENTATION

Psychologists have long noted that one of the most robust gender differences regarding human sexuality is that women tend to place greater emphasis on relationships as a context for sexual feelings and behaviors than do men (Peplau, 2003). For example, many lesbian and bisexual women report that they were never aware of same-sex desires until after they fell in love with a particular woman (Diamond, 2003). One potential reason for this gender difference is that women appear more likely than men to have their first experiences of sexual arousal in the context of a heterosexual dating relationship, rather than the solitary context of masturbation. Another potential contributor to this gender difference is that historically women have been socialized to restrict their sexual feelings and behaviors to intimate emotional relationships—ideally, marital ties—whereas males have enjoyed more social license regarding casual sexual relations.

Yet our emerging understanding of the neurochemical substrates of love and desire raises the intriguing possibility that biological factors might also contribute to this gender difference. Specifically, several of the neurochemicals that mediate mammalian bonding processes—most notably, oxytocin, vasopressin, and dopamine—also mediate sexual behavior, and these neurochemicals often show hormone-dependent, gender-specific patterns of functioning. For example, female rats have far more extensive oxytocin brain circuits than do male rats, perhaps to facilitate oxytocin-dependent caregiving behaviors, and oxytocin interacts with estrogen to regulate female rats’ sexual receptivity (Panksepp, 1998). Among humans, women show greater oxytocin release during sexual activity than do men, and some women show correlations between oxytocin release and orgasm intensity (Carmichael et al., 1994). Such findings raise the provocative possibility that women’s greater emphasis on the relational context of sexuality—that is, their greater experience of links between love and desire—may be influenced by oxytocin’s joint, gender-specific role in these processes (in addition to culture and socialization).

Furthermore, the fact that women sometimes develop same-sex desires as a result of falling in love with female friends (a phenomenon rarely documented among men) might be interpreted to indicate that oxytocin-mediated links between love and desire make it possible for a woman’s affectionally triggered desires to “override” her general sexual orientation. In other words, whereas the fundamental independence between love and desire means that individuals’ sexual orientations do not necessarily circumscribe their capacity for affectional bonding, the biobehavioral links between love and desire may make it possible for either experience to trigger the other (Diamond, 2003). Although this might be true for both sexes, it is perhaps more likely for women because of both gender-specific oxytocin-mediated processes and the greater cultural permission for women to develop strong affectional bonds with members of their own sex (for a similar argument regarding same-sex female bonds and gender-differentiated patterns of stress response, see Taylor et al., 2000).

These notions run counter to the conventional notion that lesbians and gay men fall in love only with same-sex partners and heterosexuals fall in love only with other-sex partners. Yet this conventional notion is also contradicted by cross-cultural, historical, and even animal research. For example, given sufficient cohabitation, both male and female prairie voles have been induced to form nonsexual bonds with same-sex partners (DeVries, Johnson, & Carter, 1997), although these bonds form more quickly and are more robust among females. One fascinating area for future research concerns the conditions under which humans form and maintain sexual and affectional relationships that run counter to their established patterns of desire and affection, the implications of such phenomena for later experience and development, and the specific role played by cognitive, behavioral, emotional, and biological mechanisms in regulating such processes.

Historically, it has been assumed that sexual arousal is a more basic, biologically mediated phenomenon than is romantic love, and therefore is more amenable to scientific study. Yet this assumption is outmoded. Research has demonstrated that the distinct behaviors and intense feelings associated with affectional bonds are governed not only by culture and socialization, but also by evolved, neurochemically mediated processes that are a fundamental legacy of our mammalian heritage. Future research on the nature and functioning of these processes in humans will not only provide researchers with novel tools to investigate age-old debates (can you fall in love with two people at once?), but will also make critical contributions to understanding the basic experience of human intimacy and how it is shaped by gender and sexual orientation over the life course.

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#### Recommended Reading

- Carter, C.S. (1998). (See References)  
 Diamond, L.M. (2003). (See References)  
 Fisher, H.E. (1998). (See References)  
 Hazan, C., & Zeifman, D. (1999). (See References)
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#### REFERENCES

- Bartels, A., & Zeki, S. (2000). The neural basis of romantic love. *NeuroReport*, *11*, 3829–3834.

- Bowlby, J. (1982). *Attachment and loss: Vol. 1: Attachment* (2nd ed.). New York: Basic Books.
- Carmichael, M.S., Warburton, V.L., Dixen, J., & Davidson, J.M. (1994). Relationships among cardiovascular, muscular, and oxytocin responses during human sexual activity. *Archives of Sexual Behavior, 23*, 59–79.
- Carter, C.S. (1998). Neuroendocrine perspectives on social attachment and love. *Psychoneuroendocrinology, 23*, 779–818.
- DeVries, A.C., Johnson, C.L., & Carter, C.S. (1997). Familiarity and gender influence social preferences in prairie voles (*Microtus ochrogaster*). *Canadian Journal of Zoology, 75*, 295–301.
- Diamond, L.M. (2003). What does sexual orientation orient? A biobehavioral model distinguishing romantic love and sexual desire. *Psychological Review, 110*, 173–192.
- Fisher, H.E. (1998). Lust, attraction, and attachment in mammalian reproduction. *Human Nature, 9*, 23–52.
- Hatfield, E. (1987). Passionate and companionate love. In R.J. Sternberg & M.L. Barnes (Eds.), *The psychology of love* (pp. 191–217). New Haven, CT: Yale University Press.
- Hatfield, E., Schmitz, E., Cornelius, J., & Rapson, R.L. (1988). Passionate love: How early does it begin? *Journal of Psychology and Human Sexuality, 1*, 35–52.
- Hazan, C., & Zeifman, D. (1999). Pair-bonds as attachments: Evaluating the evidence. In J. Cassidy & P.R. Shaver (Eds.), *Handbook of attachment theory and research* (pp. 336–354). New York: Guilford.
- Panksepp, J. (1998). *Affective neuroscience: The foundations of human and animal emotions*. New York: Cambridge University Press.
- Peplau, L.A. (2003). Human sexuality: How do men and women differ? *Current Directions in Psychological Science, 12*, 37–40.
- Taylor, S.E., Klein, L.C., Lewis, B.P., Gruenewald, T.L., Gurung, R.A.R., & Updegraff, J.A. (2000). Biobehavioral responses to stress in females: Tend-and-befriend, not fight-or-flight. *Psychological Review, 107*, 411–429.
- Tennov, D. (1979). *Love and limerence: The experience of being in love*. New York: Stein and Day.
- Turner, R.A., Altemus, M., Enos, T., Cooper, B., & McGuinness, T. (1999). Preliminary research on plasma oxytocin in normal cycling women: Investigating emotion and interpersonal distress. *Psychiatry, 62*, 97–113.

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